

WHAT IS CLAIMED IS:

1. A one-dimensional piezoelectric actuator array comprising: a piezoelectric device which comprises a plate or pillar-shaped piezoelectric member, and at least one pair of electrodes formed on the piezoelectric member: said piezoelectric device being driven based on a piezoelectric effect of the piezoelectric member and being disposed in a planar form,

wherein the piezoelectric device constitutes a piezoelectric device substrate, is formed in a planar comb shape as a whole in which comb teeth are connected to one another at one end of the piezoelectric device, and comb-teeth portions thus formed are functioned as a plurality of driving portions,

wherein a guide substrate having a concave portion for housing at least a part of the piezoelectric device substrate is further provided in a predetermined position, and

wherein the guide substrate and the piezoelectric device substrate are integrally unified in such a manner that a resultant is readily usable for formation of multiply stuck structural body.

2. The one-dimensional piezoelectric actuator array according to claim 1,

wherein the guide substrate includes projections and/or ridges arranged at an interval corresponding to a width between the driving portions positioned adjacently each other in a bottom surface of the concave portion for housing, and

wherein the respective projections and/or ridges are inserted between driving portions positioned adjacently each other, and the guide substrate and the piezoelectric device substrate are integrally unified.

3. The one-dimensional piezoelectric actuator array according to claim 2, wherein a wiring circuit is further disposed on the guide substrate and connected to the electrodes.

5           4. A two-dimensional piezoelectric actuator array comprising a plural number of one-dimensional piezoelectric actuator arrays multiply stuck, and a plurality of driving portions is structurally aligned and arranged in a plural number,

          wherein said one-dimensional piezoelectric actuator array  
10 comprising: a piezoelectric device which comprises a plate or pillar-shaped piezoelectric member, and at least one pair of electrodes formed on the piezoelectric member: said piezoelectric device being driven based on a piezoelectric effect of the piezoelectric member and being disposed in a planar form,

15           wherein the piezoelectric device constitutes a piezoelectric device substrate, is formed in a planar comb shape as a whole in which comb teeth are connected to one another at one end of the piezoelectric device, and comb-teeth portions thus formed are functioned as a plurality of driving portions,

          wherein a guide substrate having a concave portion for housing at  
20 least a part of the piezoelectric device substrate is further provided in a predetermined position, and

          wherein the guide substrate and the piezoelectric device substrate are integrally unified in such a manner that a resultant is readily usable for formation of multiply stuck structural body.

25           5. The two-dimensional piezoelectric actuator array according to claim 4, wherein the guide substrate includes projections and/or ridges

arranged at an interval corresponding to a width between the driving portions positioned adjacently each other in a bottom surface of the concave portion for housing, and

5 wherein the respective projections and/or ridges are inserted between driving portions positioned adjacently each other, and the guide substrate and the piezoelectric device substrate are integrally unified.

6. The two-dimensional piezoelectric actuator array according to claim 4, wherein a wiring circuit is further disposed on the guide substrate  
10 and connected to the electrodes.

7. A two-dimensional piezoelectric actuator array: comprising a structurally aligned plural number of piezoelectric devices each of which comprises a plate or pillar-shaped piezoelectric member, and at least one pair  
15 of electrodes formed on the piezoelectric member: said piezoelectric device being driven based on a piezoelectric effect of the piezoelectric member and being disposed in a planar form,

wherein the piezoelectric device constitutes a piezoelectric device substrate, is formed in a planar comb shape as a whole in which comb teeth are  
20 connected to one another at one end of the piezoelectric device, and comb-teeth portions thus formed are functioned as a plurality of driving portions,

wherein a first guide frame member is disposed additionally: said first guide frame being of a hollow box shape and having a plurality of pairs of guide grooves for housing a plurality of piezoelectric device substrates  
25 formed on two inner surfaces facing each other of the guide frame member in accordance with a number of piezoelectric device substrates to be housed in an aligned state in a predetermined position at a predetermined interval, and

said guide grooves being arranged at an interval corresponding to a thickness of the piezoelectric device substrate, and

wherein the plurality of piezoelectric device substrates is inserted and housed in the corresponding guide grooves of the first guide frame member, and the plurality of driving portions are structurally aligned/arranged.

8. The two-dimensional piezoelectric actuator array according to claim 7 which further comprises a lid member in which slits are formed at an interval same as an interval between two guide grooves positioned adjacently each other; said slits having a shape corresponding to a shape of tip ends of the plurality of driving portions,

wherein the tip ends of the plurality of driving portions are inserted into the slits to be fixed at predetermined positions, respectively.

9. The two-dimensional piezoelectric actuator array according to claim 8 which further comprises wiring components having a structure aligned/arranged in a spatial manner same as that of the plurality of driving portions and being connected to respective electrodes.

10. A one-dimensional piezoelectric actuator array comprising: a plurality of piezoelectric devices each of which comprises a piezoelectric device which comprises a plate or pillar-shaped piezoelectric member, and at least one pair of electrodes formed on the piezoelectric member: said piezoelectric device being driven based on a piezoelectric effect of the piezoelectric member and being disposed in a planar form,

wherein a plurality of piezoelectric devices is arranged in a planar form in an independently separated state,

wherein a guide substrate having a concave portion for housing at least a part of each of the plurality of piezoelectric devices at a predetermined position is further disposed in addition to a plurality of piezoelectric devices, and

5            wherein the guide substrate and the plurality of piezoelectric devices are integrally unified, thereby a resultant is easily multiply stuck to from a multiply stuck structural body.

11. A two-dimensionally aligned piezoelectric actuator array  
10 comprising a spatially aligned plurality of piezoelectric devices each of which comprises a piezoelectric device which comprises a plate or pillar-shaped piezoelectric member, and at least one pair of electrodes formed on the piezoelectric member; said piezoelectric device being driven based on a piezoelectric effect of the piezoelectric member and being disposed in a  
15 planar form,

wherein a second guide frame member is disposed additionally; said second guide frame member having a plurality of openings arranged in a grid form, and a housing space being channeled through the plurality of openings and fixing a plurality of piezoelectric devices by housing it, and

20            wherein the respective piezoelectric devices are fixed by inserting the plurality of piezoelectric devices to the corresponding plurality of openings of the housing space of the second guide frame member, thereby the plurality of piezoelectric devices are spatially aligned/arranged.

25            12. The two-dimensional piezoelectric actuator array according to claim 11 which further comprises wiring components having a structure aligned/arranged in a spatially manner same as that of the plurality of

driving portions and being connected to respective electrodes.

13. A manufacturing method of a one-dimensional piezoelectric actuator array comprising at least one piezoelectric device which comprises a plate or pillar-shaped piezoelectric member, and at least one pair of electrodes formed on the piezoelectric member: said piezoelectric device being driven based on a piezoelectric effect of the piezoelectric member and being disposed in a planar form, the method comprising the steps of:

forming a piezoelectric material in a sheet shape to prepare a piezoelectric sheet;

forming a pair of electrodes on at least one surface of the piezoelectric sheet;

forming the piezoelectric sheet in a planar comb shape as a whole in which comb teeth are connected to one another at one end of the piezoelectric sheet to prepare a piezoelectric device substrate in which comb-teeth portions function as a plurality of driving portions;

preparing a guide substrate having a concave portion for housing at least a part of the piezoelectric device substrate with unifying integrally them in a predetermined position; and

housing the piezoelectric device substrate in the guide substrate to prepare the one-dimensional piezoelectric actuator array in which the plurality of driving portions constituting the piezoelectric device substrate are aligned/arranged in the planar manner.

14. A manufacturing method of a piezoelectric actuator array comprising structurally aligned pluralities of piezoelectric devices each of which piezoelectric device comprises a plate or pillar-shaped piezoelectric

member, and least one pair of electrodes formed on the piezoelectric member:  
said piezoelectric device being driven based on a piezoelectric effect of the  
piezoelectric member and being disposed in a planar form, the method  
comprising the steps of:

5                   forming a piezoelectric material in a sheet shape to prepare a  
piezoelectric sheet;

                  forming a pair of electrodes on at least one surface of the  
piezoelectric sheet;

                  forming the piezoelectric sheet as a whole in a planar comb shape in  
10   which comb teeth are connected to one another in one end to prepare a  
plurality of piezoelectric device substrates in which comb-teeth portions  
constitute a plurality of driving portions;

                  preparing a guide substrate having a concave portion for housing at  
least a part of the piezoelectric device substrate to be integrally housed in  
15   a predetermined position;

                  housing the piezoelectric device substrate in the guide substrate to  
prepare a one-dimensional piezoelectric actuator array; and

                  stacking multiply a plurality of one-dimensional piezoelectric  
actuator arrays to prepare the two-dimensional piezoelectric actuator array in  
20   which the plurality of driving portions constituting the piezoelectric device  
substrate are structurally aligned/arranged.

15. The manufacturing method of the two-dimensional piezoelectric  
actuator array according to claim 14, further comprising the steps of:

25                   forming positioning means having a positioning function at time for  
sticking multiply the plurality of one-dimensional piezoelectric actuator  
arrays in the guide substrate;

housing the piezoelectric device substrate in the guide substrate to prepare the one-dimensional piezoelectric actuator array, and

forming a two-dimensional piezoelectric actuator array in which the plurality of driving portions constituting the piezoelectric device substrate are structurally aligned/arranged by using the function of the positioning means to stack multiply thus formed plurality of one-dimensional piezoelectric actuator arrays.

16. The manufacturing method of the two-dimensional piezoelectric actuator array according to claim 15, wherein the positioning means comprises a through hole and/or a marker.

17. A manufacturing method of a piezoelectric actuator array comprising a structurally aligned plural number of piezoelectric devices each of which comprises a plate or pillar-shaped piezoelectric member, and at least one pair of electrodes formed on the piezoelectric member: said piezoelectric device being driven based on a piezoelectric effect of the piezoelectric member and being disposed in a planar form, the method comprising the steps of:

forming a piezoelectric material into a sheet shape to prepare a plural number of piezoelectric sheets;

forming a pair of electrodes in at least one surface of each piezoelectric sheet, respectively;

forming each piezoelectric sheet in a planar comb shape as a whole in which comb teeth are connected to one another in one end of the piezoelectric sheet to prepare each piezoelectric device substrate in which comb-teeth portions constitute a plurality of driving portions;



preparing a first guide frame being of a hollow box shape and having a plurality of pairs of guide grooves for housing a plurality of piezoelectric device substrates in two inner surfaces facing each other of the guide frame member in accordance with a plural number of piezoelectric device substrates to be housed therein in an aligned state in a predetermined position at a predetermined interval, and said guide grooves being arranged at an interval corresponding to a thickness of the piezoelectric device substrate; and

housing a predetermined plural number of piezoelectric device substrates in guide grooves of the first guide frame member to prepare a two-dimensional piezoelectric actuator array in which the plurality of driving portions constituting the piezoelectric device substrate is structurally aligned/arranged.